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August 3, 2011

Mr. Robert Parker
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U.S. Environmental Protection Agency, Region 8
Mail Code: 8EPR-B
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SUBJECT: START 3, EPA Region 8, Contract No. EP-W-05-050, TDD No. 1105-06 Preliminary Assessment Report, Smurfit-Stone Mill, Missoula, Missoula County, Montana

Dear Robert:

Attached is one copy of the draft Preliminary Assessment Report for the Smurfit-Stone Mill site near Missoula, Missoula County, Montana. As you are aware, a site reconnaissance was conducted on June 22, 2011. This document is submitted for your review and comments.

If you have any questions, please call me at 303-291-8212.

Sincerely,

URS OPERATING SERVICES, INC.

Jeff Miller
Project Manager

cc: Charles W. Baker/UOS (w/o attachment)
File/UOS

START 3

Superfund Technical Assessment and Response Team 3 – Region 8

United States
Environmental Protection Agency
Contract No. EP-W-05-050

PRELIMINARY ASSESSMENT

SMURFIT-STONE MILL
Missoula, Missoula County, Montana

TDD No. 1105-06

August 3, 2011

URS
OPERATING SERVICES, INC.

In association with:
Garry Struthers Associates, Inc.
LT Environmental, Inc.
TechLaw, Inc.
Tetra Tech EMI
TN & Associates, Inc.

PRELIMINARY ASSESSMENT

Smurfit-Stone Mill
Missoula, Missoula County, Montana
MTN000802850

EPA Contract No. EP-W-05-050
TDD No. 1105-06

Prepared By:
Jeff Miller
Project Manager

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Approved: ______________________________ Date: ____________
Robert Parker, Site Assessment Manager, EPA, Region 8

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Approved: ______________________________ Date: ____________
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DISTRIBUTION LIST

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PRELIMINARY ASSESSMENT

Smurfit-Stone Mill
Missoula, Missoula County, Montana
MTN000802850

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1.0 INTRODUCTION

This Abbreviated Preliminary Assessment (PA) of the Smurfit-Stone Mill site (CERCLIS ID# MTN000802850) near Missoula, Missoula County, Montana, has been prepared to satisfy the requirements of Technical Direction Document (TDD) No. 1105-06 issued to URS Operating Services, Inc. (UOS) by the Region 8 office of the U.S. Environmental Protection Agency (EPA) under Superfund Technical Assessment and Response Team 3 (START) contract # EP-W-05-050. Site reconnaissance was conducted by UOS personnel on June 22, 2011 in the company of Robert Parker of the EPA. This PA report is the result of observations made during the site reconnaissance and information obtained from historical records; federal, state, and local agencies; and personal interviews. This PA report has been prepared in accordance with "Guidance for Performing Preliminary Assessments under CERCLA" (EPA 1991).

2.0 OBJECTIVES

The objectives of a PA are to gather data and desktop information and evaluate potential sources, pathways, and targets to identify data gaps, to determine if a site requires sampling and, if so, appropriate sampling locations, matrices, and analytes.

Specifically, the objectives of this PA are to:

- Review historical data regarding site use and any investigative activities that have been performed at and near the site;
- Determine likely contaminant characteristics and quantify waste sources;
- Determine receptor targets and applicable pathways;
- Assess potential routes for contaminant migration;
- Identify targets potentially at risk from contaminant migration, specifically surface water users, wetlands, game fish populations, and groundwater users; and
- Determine the potential impacts to public health and the environment from the identified sources.

3.0 SITE DESCRIPTION

3.1 SITE LOCATION AND DESCRIPTION

The Smurfit-Stone Mill was a large integrated pulp and paper mill that was in operation from 1957 through early 2010 (Photos 1, 2, 38). The former mill is located 11 miles northwest of the

City of Missoula, in Missoula County, Montana and covers approximately 3,200 acres (Figure 1). The mill is located approximately 3 miles south of the town of Frenchtown and, therefore, has often been referred to as the Frenchtown Mill. The facility address is 14377 Pulp Mill Road, Missoula, and the coordinates of the main mill facility are 46° 57′ 50.12″ north longitude and -114° 11′ 58.15.98″ west latitude.

The mill site is located in the northeastern portion of the U.S. Geological Survey (USGS) Primrose Quadrangle Map (USGS 1999). For this PA, the site boundary is defined by the outside perimeter of the land parcels that constitute the mill property. The legal description of these parcels is provided in Appendix A, and the site boundary is shown in Figures 1 and 2. The western boundary of the site is the Clark Fork River, with the site having approximately 4 miles of river frontage (Photos 1, 6, 13, 14).

The area of influence of the site is defined as a 4-mile radius surrounding the outside perimeter of the mill property, and the Clark Fork River to a distance 15 miles downstream of the mill site (Figure 1). The area of influence includes creeks draining into the Clark Fork River (Deep, Albert, O'Keefe, Mill, Sixmile, and Ninemile Creeks), as well as the Frenchtown Ponds State Park and portions of the Lolo National Forest. The site lies within the Montana Audubon Clark Fork River – Grass Valley Important Bird Area (Montana Audubon 2009).

The mill site lies within the Clark Fork River valley and is generally flat, with an elevation range from approximately 3,070 feet near the mill facility to approximately 3,040 feet at the Clark Fork River in the northwest corner of the site. Elevations within the 4-mile radius range from approximately 3,015 feet within the Clark Fork River valley to the northwest, to nearly 5,000 feet in the mountains to both the east and west.

The core industrial footprint of the mill site covers approximately 100 acres. Over 900 acres of the site consist of a series of unlined ponds used to store both treated and untreated wastewater effluent from the mill, as well as primary sludge recovered from untreated wastewater. Additional unlined ponds were also subsequently used for landfilling various solid wastes produced at the mill. Approximately half of the ponds contain freshwater emergent wetlands. Much of the remaining acreage of the site (approximately 2,000 acres) is used for agricultural purposes, with over 1,200 acres of grasslands for cattle grazing and over 600 acres leased for alfalfa and grain crops (Montana County Rural Initiatives 2010).

3.2 SITE HISTORY

The site began operation as a pulp mill in the fall of 1957. Later expansions and improvements allowed the facility to produce paper, primarily rolls of kraft linerboard that is used in the production of corrugated containers (i.e., the outside layers of cardboard boxes). Linerboard produced at the mill was shipped to box plants where it was used to make a variety of corrugated containers (Smurfit-Stone undated). The mill shut down operations in January 2010.

A timeline of the mill's history, with an emphasis on wastewater discharge information, is provided below (Montana Department of Health and Environmental Sciences [MDHES] 1974, Nielsen 1987):

- 1956: Waldorf Paper Products Co. of St. Paul, Minnesota announces it will start construction of a $6 million pulp mill northwest of Missoula. Groundbreaking occurs in November, 1956.
- 1957: Pulp mill begins operation in November with 78 employees and a production capacity of 250 tons per day (tpd) of kraft pulp. No wastewater treatment is initially provided at the mill.
- 1958: First wastewater storage ponds constructed in August following complaints of fish kills, foam, and discoloration in the Clark Fork River. Allowable discharges to river are negotiated with authorities to occur only during high flow periods (March through June). Remainder of discharge is through infiltration through bottom of unlined storage ponds during the storage period of roughly July through February.
- 1960: Mill name becomes Waldorf-Hoerner when Hoerner increases its share to 50 percent. First paper machine and bleaching operation installed in $6 million expansion. Production increases to 450 tpd of linerboard and 150 tpd of bleached pulp.
- 1962: Montana Board of Health negotiates first discharge conditions with mill for spring discharge season.
- 1966: Mill name becomes Hoerner Waldorf Corporation when Waldorf Paper Products and Hoerner Boxes merge. Second paper machine and two continuous digesters are installed. Capacity increased to 1,150 tpd, of which 150 tpd is bleached pulp.

- 1968: Mill issued first discharge permit by MDHES. Direct discharge allowed to Clark Fork River in spring (high flow) conditions.
- 1969: Primary clarifier installed to remove suspended solids from wastewater prior to storage in settling ponds.
- 1970: Two recovery boilers constructed along with other pollution control measures to reduce emission of odorous gases.
- 1974-1975: Mill installs secondary treatment aeration basins and three experimental 'rapid infiltration' percolation ponds constructed to handle increasing wastewater production. Seven hundred acres of settling ponds are in existence. One-third of 15.7 million gallons per day (mgd) of wastewater effluent is discharged directly to Clark Fork River following primary (clarifier) and secondary treatment. Remainder of wastewater either evaporates or infiltrates through bottom of ponds. An additional 8 mgd of uncontaminated cooling water is discharged to the river after passing through a ditch to a low lying area to the north of the mill site. First Montana Pollution Discharge Elimination System (MPDES) permit issued in July 1975.
- 1977: Champion International Company purchases mill and begins 3-year $170 million expansion to increase capacity to 1,850 tpd. Majority of wastewater (63 percent) is being disposed of through rapid infiltration ponds.
- 1978: Second MPDES permit issued.
- 1980: Third paper machine, support systems, and a waste wood boiler for power generation installed.
- 1982: Third MPDES permit issued.
- 1983: Champion applies for permit to allow a portion of effluent to be directly discharged to Clark Fork River throughout the year as rapid infiltration ponds have largely clogged and lost their infiltration capacity.
- 1984: MDHES issues 2-year temporary permit allowing year-round direct discharge and begins study to determine its effects on river. Only 14 percent of wastewater is infiltrating through ponds.
- 1986: Stone Container Corporation purchases mill. MDHES extends permit until an addendum can be completed.

- 1988: Stone Container Corporation completes construction of color removal treatment system to address additional color contributed to wastewater by bleach plant.
- 1990: Old Corrugated Container (OCC) facility added to recycle (repulp) old cardboard containers. First documentation of on-site asbestos disposal.
- 1991: Expanded array of site-wide groundwater monitoring wells installed to comply with MPDES permit.
- 1993: Pulp mill production is approximately 1,900 tons of pulp per day (1,500 tons of virgin kraft pulp from wood chips and 400 tons from repulping old corrugated containers). Closure of three onsite disposal areas and beginning of offsite disposal of asbestos.
- 1994: Montana DEQ issues a Class III landfill license to Stone Container Corporation for land north of Pond 16.
- 1995: New MPDES permit issued, addresses nutrients for first time and requires surface water mixing zone study.
- 1997: Sludge dewatering facility constructed and becomes operational.
- 1998: Name becomes Smurfit-Stone Container Corporation when Jefferson Smurfit Corporation merges with Stone Container Corporation.
- 1999: Bleaching plant operations cease, Color Removal Plant treatment discontinued.
- 2000: Five-year MPDES permit issued with reduced levels for nitrogen and phosphorus, and requirements for delineating the groundwater mixing zone.
- 2001-2004: Business conditions curtail production to 1,600 tpd of linerboard from 1100-1200 tpd of virgin pulp and 550 tpd of recycled pulp from the OCC. Two of three paper machines in operation.
- 2004: Name changed to Smurfit-Stone Container Enterprises Incorporated.
- 2005: Smurfit-Stone Container Enterprises, Inc. applies for a Solid Waste Class III Landfill license for the Peterson Gravel Pits
- 2009: Smurfit-Stone files for Chapter 11 bankruptcy in January.
- 2010: Smurfit-Stone emerges from bankruptcy, but shuts down mill in January.
- 2011: Mill property purchased by MLR Investments in March. Mill property purchased by M2 Green (Green Investment Group Incorporated) in May.

3.3 PROCESS DESCRIPTION AND WASTE TYPES GENERATED

Sawdust, woodchips and rejected timber ('pulp logs') provided the raw wood materials for the mill. Woodchips were brought to the mill by both truck and rail at a rate of up to 3,700 tpd to produce up to 2,200 tpd of linerboard. Other raw materials used in the pulping process included: clay, starch, caustics, 'hogged fuel' (bark, sawdust, and reject wood/hips burned for power generation), and various processing chemicals. From 1990 on, the mill recycled corrugated containers (up to 400 tpd), which provided raw fiber for pulping. Approximately 85 percent of the kraft linerboard produced at the mill was used domestically, being shipped to other facilities within the corporation (EPA 1993).

The basic process employed at the mill involved the following five steps:

- Raw material (wood) preparation,
- Separation of wood fibers (pulping),
- Removal of coloring agents (bleaching),
- Paper formation, and
- Power generation/recovery of chemicals.

Raw wood was received as wood chips, sawdust, and logs, which the facility was equipped to debark and chip. The second step, separation of wood fibers or pulping, was accomplished by the use of chemicals (sodium hydroxide and sodium sulfide in a solution called 'white liquor') used at high temperatures with pressures to dissolve impurities and lignins that bind the wood fibers together in process vessels called digesters (large pressure cookers). The Smurfit-Stone Mill used both batch and continuous digesters. The resulting spent cooking chemical is called 'black liquor' (EPA 1993).

Removal of coloring agents (bleaching) is performed only if a light colored or white paper is desired. The mill used a four-step process to produce a specialty grade of white linerboard. Paper formation involved three stages of production: wet end, press section, and dryers. In the wet end, pulp is routed to the paper mill where various chemical additives such as rosin, alum (an aluminum sulfate complex used to precipitate the rosin onto the paper), dyes, and clay (a filler) are added. Fiber slurry is screened, and a sheet is formed by distributing a web of fiber onto a continuously moving screen. The sheet is pressure rolled and then dried on heated cylinders. These processes serve to reduce the moisture content of the product from over 99 percent to less than 6 percent.

The final step in the process is the reclamation of spent cooking liquor, which is concentrated using evaporators and burned in recovery boilers that burn organic wastes. Inorganic material (sodium and sulfur) in the concentrated black liquor is collected as a molten 'smelt' in the bottom of each recovery furnace and overflows into a smelt dissolving tank, forming 'green liquor.' The green liquor is processed back into white cooking liquor through a recausticizing process using sodium hydroxide, lime kilns, lime mud filtering, washers, and clarifiers. The boilers supply enough excess heat to generate steam power that is used to help run the mill (EPA 1993).

From 1990, recycled pulp was also produced from OCC by thermo-mechanical pulping processes that did not use the cooking liquors described above. Specialized equipment was used to remove impurities (i.e., waxes, glues, plastics, Styrofoam, plastic, staples). This recycled pulp contributed approximately 550 tpd to total pulp production.

Various hazardous chemicals were used or produced on site, including bleaching chemicals (liquid chlorine, sodium hypochlorite, and chlorine dioxide), liquid sulfur dioxide, liquid ammonia, sodium hydroxide, sodium salts, dimethyl disulfide, methylsulfide, liquors of high pH (white, green and black) used in pulping, turpentine, acids (sulfuric, muriatic, and phosphoric), and non-condensable gases. Various quantities of bulk petroleum products, including diesel fuel and #6 fuel oil, were stored on site. Polychlorinated biphenyls (PCBs) were used in electrical transformers at the site, but it has been reported that these have been removed (Marxer 2011). No spills appear to have been reported during removal activities.

From 1986 through March 2010, the mill was registered under the Resource Conservation and Recovery Act (RCRA) as a Small Quantity Generator of hazardous waste (specifically in 2009 for ignitable waste, mercury, methyl ethyl ketone, and methylene chloride) (MDEQ 2011a).

Waste types generated at the mill included solid, liquid, and gaseous emissions. Solid wastes were landfilled on site in at least four separate areas until October 1993, when the landfills were closed to comply with solid waste disposal laws (Smurfit-Stone 2004). Also in 1993, Smurfit-Stone licensed and began using a Class III (inert material) disposal site located in the northwestern area of the mill site. In November 2005, Smurfit-Stone applied for a license for an additional Class III landfill to convert the Peterson Gravel Pits on the site to a landfill. This license appears to have been denied. After 1993, Class II wastes (e.g., general refuse, fly ash, asbestos) generated by the facility were disposed of off site at BFI's Missoula landfill.

Waste types generated by the mill are shown in the following table (MDHES 1974, 1985; EPA 1993; Smurfit-Stone 2004; MDEQ 2010a):

TABLE 1
Waste Types Generated at the Smurfit-Stone Mill Site

Waste	Possible Contaminants	Approximate Volume Generated (Annually)	Disposal Location
SOLIDS			
Primary sludge[1]	Dioxins, furans, PCBs, organic halides, chlorinated phenols, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), arsenic, cadmium and other metals	20,000 tons	Onsite (ponds 3, 4, 5, 17, and likely ponds 19 (aka 'area D') and 20 (aka 'area E')
General municipal waste[2]	Industrial chemicals (e.g., solvents), degradation products	148,000 cubic yards (yd^3)	Onsite (pond A (aka 'area A') until 1993, then offsite to BFI
Hog Fuel ash[3]	Unknown	20,000 yd^3	Onsite (pond 6, Area C) until 1993, then offsite to BFI
Lime kiln/ slaker grits[4]	Unknown	17,000 yd^3	Onsite (pond 6, Area C) until 1993, then sludge ponds
Ragger wire[5]	Unknown	7,000 yd^3	Onsite (Area C) until 1993, then offsite to BFI
Asbestos[6]	unknown	Onsite (total generated 1990-1993): 2,870 linear feet (lf) of pipe insulation, 1,078 square feet (ft^2) of boiler insulation Offsite (total generated 1990-2008): 17,758 lf of pipe insulation and 13,997 ft^2 of other materials	Onsite (Areas F, G) until 1993, then offsite to BFI
Woodyard waste[7]	unknown	12,000 yd^3	Onsite (Area G)
LIQUIDS			
Wastewater[8]	Dioxins, furans, PCBs, organic halides, chlorinated phenols, petroleum hydrocarbons, PAHs, arsenic, cadmium and other metals, nutrients	Up to 6.02 billion gallons (e.g., 1984). Ave 5.7 billion gallons (e.g., 2009).	Combination of: • direct discharge to Clark Fork River, • 'rapid infiltration' through ponds to groundwater, • pond seepage to groundwater, and • evaporation

TABLE 1
Waste Types Generated at the Smurfit-Stone Mill Site

Waste	Possible Contaminants	Approximate Volume Generated (Annually)	Disposal Location
Black, green, white liquors; bleaching waste streams[9]	high pH liquids, chlorine, salts, acids (sulfuric, muriatic, and phosphoric)	unknown	Largely recovered and recycled, but some losses to sewer due to overflows, spills, and wash-ups.
Cooling water (non-contact)	unknown	Avg. 2.37 billion gallons	Direct discharge to Clark Fork River
GASES			
Total reduced sulfur compounds; oxides of sulfur (SOx); oxides of nitrogen (NOx)	• hydrogen sulfide (H2S), • methyl mercaptan, • dimethyl sulfide, • dimethyl disulfide, SOx, NOx	Varies per source, up to limits imposed by Montana Air Quality Permit issued for site (#2589-15)	Discharge to air controlled variously by electrostatic precipitators, wet scrubbers and wet venture scrubbers, baghouses, air and steam strippers
Particulates	• sodium sulfate, • sodium carbonate, • other sodium compounds	Varies per source, up to limits imposed by Montana Air Quality Permit issued for site (#2589-15)	Discharge to air controlled variously by electrostatic precipitators, wet scrubbers and wet venture scrubbers, baghouses, air and steam strippers

1 Primary sludge is the underflow from the primary clarifier, and has been reported to be primarily composed of water, hog fuel ash, lime, calcium carbonate mud, green liquor dregs (unburned carbon from recovery boilers) and 1 percent wood pulp fiber.
2 General municipal waste consisted of miscellaneous waste such as paper, plastic, wood, scrap metal, glass, and small amounts of food.
3 Hog fuel ash originated from multicyclone collectors on two bark boilers and from the bottom grates in the boilers.
4 Lime kiln/slaker grits are unreacted lime kiln product that is rejected from the slaker where reburned lime (CaO) is added to green liquor ($NaOH + Na_2S$).
5 Ragger wire is plastic and metal wire that holds bales of old cardboard containers together.
6 Asbestos originated from disturbed insulation and through maintenance and replacement of equipment.
7 Woodyard waste was generally wood chips that got mixed with soil and rocks at the bottom of a stockpile.
8 Approximately 200 organic compounds have been identified in pulp, paper, and paperboard wastewaters. The principal waste parameters of concern with these waters are wood waste residuals that produce biological oxygen demand (BOD), pH, total suspended solids, and effluent color from bleaching operations.
9 Black liquor is spent cooking liquor remaining after the digesting process. It contains spent cooking chemicals, ligins, and other extractions from the pulp with a solids content of ~18 percent. After further evaporation, ligins and organic wastes are burned in power recovery boilers. Molten inorganics (e.g., sodium and sulfur) are recovered in the bottom of the recovery furnace, forming green liquor. Green liquor is processed back into white liquor in the recausticizing process, which uses lime kilns, slakers, lime mud filters, washers and clarifiers. Its chemical constituents are largely sodium hydroxide and sodium sulfide.

The pulp and paper industry uses a large volume of water as a fiber carrier and solvent. As little of this was recycled at the Smurfit-Stone facility, it generated vast amounts of wastewater, up to 6.02 billion gallons per year.

During its initial operation, all wastewater was apparently released directly to the Clark Fork River without treatment (Nielsen 1987). Beginning in 1958, wastewater was stored onsite in unlined ponds from July through February before being discharged to the river under high flow, spring runoff conditions (March through June). During the storage months, a substantial amount of water seeped through the bottom of the storage ponds. Over the years, as the mill expanded and as the seepage rates from the ponds decreased due to accumulation of biological and residual organic solids in the bottom sediments of the ponds, additional storage ponds were constructed (Nielsen 1987).

A primary clarifier was constructed in 1969 to remove solid constituents (primary sludge) from the waste water, which was pumped into four sludge ponds. Beginning in 1974, the mill experimented with 'rapid-infiltration' gravel basins as a means to facilitate seepage rates into groundwater. This process largely ended by 1983 due to clogging of the basins by organic matter.

Secondary treatment, in the form of a two-stage aeration basin, also began at the mill in 1974. A third basin was added in 1990. From the aeration basins, wastewater flowed to polishing ponds, and then on to a series of treated water storage ponds before discharge to one of three outfalls. Year-round discharge of treated wastewater to the Clark Fork River began in 1984, being permitted only when river flows exceeded 1,900 cubic feet per second (Smurfit-Stone 2004).

Wastewater flow diagrams are presented in Appendix E (Smurfit-Stone 2004).

3.4 PREVIOUS INVESTIGATIONS

Previous environmental investigations at the site appear to have been undertaken by both the mill and by the MDHES, largely to document surface and groundwater quality in an effort to understand and address nutrient loading to the Clark Fork River. For example, beginning in 1983 the MDHES conducted a 2-year study to determine the effects of year-round direct discharge of wastewater from the mill to the Clark Fork River (MDHES 1985). The study documented nutrient, suspended solids, dissolved oxygen, ammonia and metals, and color concentrations in the river; investigated its ecological health (e.g., macro-invertebrate sampling); and identified aesthetics (especially the appearance of foam and colored water), groundwater pollution of the shallow aquifer, and ongoing air quality degradation (especially odor and particulates) as areas of concern.

The 1995 MPDES discharge permit required the mill to conduct a surface water mixing zone study to delineate the boundary condition of the mixing zone for the direct discharge of wastewater to the Clark Fork River (Hydrometrics 1996). The finding of this study determined that the downstream monitoring station for the Mill (i.e., the Huson sampling station located 6 miles downstream) was a valid location for compliance monitoring and a reasonable location for determination of the mixing zone boundary.

The MPDES permit issued in 2000 required that the mill delineate the groundwater mixing zone boundary condition, defined as the extent of travel of seepage where the groundwater concentration for total dissolved solids (TDS) was greater than or equal to 500 milligrams per liter (mg/L). The permit also required Smurfit-Stone to monitor groundwater wells (Photo 11) for the purpose of establishing correlation factors for concentrations of nutrients between newer and older monitoring wells. This investigative work was completed in November 2004 (Hydrometrics and Inskeep 2004).

Environmental compliance monitoring performed at the site included the following (EPA 1993, MDEQ 2010b, Smurfit-Stone 2004):

- wastewater discharge: nutrients (nitrogen and phosphorus), pH, BOD, total organic carbon (TOC), total suspended solids (TSS), ammonia, color and toxicity, with occasional testing for dioxins;
- non-contact cooling water discharge: oil sheen, foam, temperature, and weekly pH;
- groundwater: nutrients, color, sodium and BOD every 2 months to determine seepage contribution the Clark Fork River;
- In-stream monitoring of the Clark Fork River: color, temperature, dissolved oxygen, and nutrients; and
- air: total reduced sulfur, opacity, NOx, sulfur dioxide, total suspended particulates, and particulate matter smaller than 10 microns in diameter (PM_{10}).

Site assessments have apparently been performed at six of eight petroleum storage tank locations at the site. The assessment found evidence of leaks at three of the tanks. The remediation of the releases is being overseen by the Petroleum Release Section of the MDEQ.

Previous investigations by the EPA appear to be limited to a chemical safety audit conducted by the Region 8 Technical Assistance Team from February 9 through 12, 1993. The purpose of the audit was to document facility processes, chemical hazards, accidental release prevention practices, and emergency response preparedness and planning (EPA 1993).

3.5 SITE GEOGRAPHY, GEOLOGY, HYDROGEOLOGY AND METEOROLOGY

3.5.1 Geography

The Smurfit-Stone Mill site is located within Missoula Valley of the Clark Fork Basin. The basin is bounded by the Continental Divide on the east and south, the Montana-Idaho state line on the west, and the Flathead River-Clark Fork divide to the north. The Missoula Valley is wedge-shaped and includes both the Missoula and Ninemile Valleys. The Valley has an area of about 180 square miles and is drained by the Clark Fork River, Ninemile Creek, and their tributaries (USGS 1999).

3.5.2 Geology and Hydrogeology

The Missoula Valley was flooded and drained during successive glaciations and interglaciations in the Pleistocene Epoch (1 million years ago to 25,000 years ago). About 12,000 years ago, the Missoula Valley lay beneath a lake nearly 2,000 feet deep. Glacial Lake Missoula formed as the Cordilleran Ice Sheet dammed the Clark Fork River just as it entered present day Idaho. Fill from the lake is estimated to reach a maximum depth of 3,000 feet within the valley (Montana Bureau of Mining and Geology [MBMG] 1965).

The mill site is underlain by alluvial sands and gravels, bounded on the west side of the Clark Fork River by Precambrian bedrock and by fine-grained Lake Missoula deposits immediately east. The shallow alluvial sands and gravels are approximately 25 to 35 feet thick beneath the mill site and thins to the east. Depth to groundwater across the site in July/August of 1991 varied from 2.4 to 19.8 feet (Grimestad 1992). Fine-grained Lake Missoula sediments (clays and silts) extend beneath the shallow alluvial gravels and are approximately 120 to 150 feet thick. The Lake Missoula sediments are underlain by a thick coarse-grained alluvial aquifer. This deeper aquifer system is the principal aquifer for water supply in the area, including Smurfit-Stones production wells (MBMG 1998, Hydrometrics and Inskeep 2004).

The fine-grained Lake Missoula sediments have a reported vertical permeability of 3.5×10^{-5} centimeters per second (cm/s). The estimated hydraulic conductivity of the deep alluvial aquifer is 5.3×10^{-1} cm/s (Grimestad 1992).

3.5.3 Meteorology

The mill site is located in a semiarid climate zone. Prevailing wind direction is from the northwest. The mean annual precipitation as totaled at the Missoula International Airport is 13.81 inches (National Oceanic and Atmospheric Administration (NOAA) 2011a). The 2-year, 24-hour rainfall event for this area is 1.37 inches (NOAA 2011b).

4.0 PRELIMINARY PATHWAY ANALYSIS

4.1 SOURCE CHARACTERIZATION

Potential sources of contamination at the site include: sludge ponds, aeration basins and treated water ponds, an emergency spill pond, landfills and other dumping locations, various process areas within the industrial footprint, a former landfarming area, and above- and underground storage tanks (Figure 2). These potential sources are discussed individually in sections below.

Contaminants of concern at similar pulp and paper mills across the country have included PCBs, petroleum hydrocarbons, PAHs, arsenic, cadmium, lead, and other metals.

In addition, the use of chlorine for the bleaching of pulp produces chlorinated organic compounds, including dioxins, furans, phenols, guaiacols, catechols, chloroform, and numerous others through the reaction of chlorine with residual lignin (EPA 1990). Organic halides are also of concern at kraft pulp mills where bleaching has been performed (EPA 1993).

4.1.1 Sludge Ponds

Following the installation of the primary clarifier in 1969, approximately 20,000 tons of sludge was generated on a yearly basis and pumped to four sludge ponds (Ponds 3, 4, 5, 17) (Photos 2, 3, 17, 18, 19, and 21) (Figure 2). These four ponds cover 91 surface acres, vary in depth from approximately 7 feet (Pond 17) to 14 feet (Pond 5), and contain approximately 899 acre-feet in total. It is not clear when these four ponds were first constructed, but given their location close to the plant, it follows that they would have been some of the earliest ponds built (i.e., late 1950s). It has been reported that Pond 4 is the oldest sludge pond and thus had been receiving sludge the longest (Marxer 2011).

Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal

(MDHES 1974, Smurfit-Stone 2004). During the site visit, no evidence of runon/runoff controls, or covers for dust control (with the exception of Pond 3) or the prevention of precipitation infiltration were noted.

At the time of the site reconnaissance on June 22, 2011, all four sludge ponds were completely or nearly dry (Photos 2, 3, 17, 18, 19, and 21). Pond 3 had recently been covered with 10 to 12 inches of wood chips, reportedly for dust control (Marxer 2011) (Photo 18).

Primary (from the clarifier) and secondary (dredged from basins and ponds) sludge was reportedly also disposed into two smaller areas (Areas 'D' [Pond 19] and 'E' [Pond 20]) (Figure 2) to the north of the four larger sludge ponds (Stone Container 1992).

The clarifier received effluent from all site drainage (i.e., sewer) and process streams, including the pulping mill and the paper mill areas, and the 'clearwater' sewer originating at the white water and stock tank overflow (excess water derived from the drying of paper) (EPA 1993) (Appendix E). The sludge primarily consisted of fiber solids, but also included a quantity of inorganic solids from the recausticizing operation (primarily calcium carbonate) and fly ash from the multi-fuel boiler, which were also directly pumped to the ponds (Smurfit-Stone 2004). Beginning in 1997, a sludge dewatering facility processed the sludge to remove additional liquid (reducing volume being sent to the ponds) and to provide a fuel source for the multi-fuel boiler (Smurfit-Stone 2004).

Previous studies have shown that when chlorine is used as a bleaching agent for brightening and purifying wood pulp, polychlorinated dibenzodioxins (PCDDs) including 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), and polychlorinated dibenzofurans (PCDFs), including 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF), can be formed (EPA 1987). Although these compounds may be present in treated effluent, wastewater sludges, and in the bleached pulps themselves, the highest concentrations were found in sludges. The compound 2,3,7,8-TCDD is strongly absorbed to soils or sediments and is considered to be essentially non-biodegradable in the environment (EPA 1990).

4.1.2 <u>Emergency Spill Pond</u>

The three sewer/process streams were continuously monitored for flow rate and conductivity to allow for the identification of spills and process upsets. When this occurred, flows could be diverted to an emergency spill pond (Pond 8) before they reached the wastewater treatment system (EPA 1993, Smurfit-Stone 2004) (Figure 2). The dates, quantities and constituents of spills are unknown.

The pond is divided into two cells, one being a 'dry' cell reportedly held in reserve unless needed (Marxer 2011). The 'dry' cell has also been reported as previously being a sludge pond, but was isolated in the early 1990s in anticipation of its being used as the next general refuse waste disposal location (Thamke 1992, Stone Container 1992). The cells have a combined surface acreage of 24 acres, an average depth of 5 feet, and a capacity of approximately 120 acre-feet. The date Pond 8 was constructed is not known. There is no evidence in available documents that Pond 8 was lined.

At the time of the site reconnaissance on June 22, 2011, the 'wet' cell of Pond 8 was mostly dry, while the 'dry' cell was dry and revegetated (Photos 5, 24, 25, 27, 30, 31). A breach was noted in the northwest corner of the 'wet' cell (Photo 27), although it is not clear when or why the breach occurred. There was no evidence of an engineered liner or runon/runoff controls.

4.1.3 Aeration Basins, Polishing Ponds, and Wastewater Ponds

After sludge was removed from the clarifier, wastewater was transferred to a series of aeration basins (Photos 4, 5, 26) which were operated in series (Smurfit-Stone 2004, Appendix E) (Figure 2). Aeration basins I and II were constructed in the early 1970s in conjunction with the installation of the clarifier, while aeration basin III (Pond 14) was constructed in 1990. In addition to aeration, supplemental nutrients (nitrates and phosphates) were added to the basins to enhance and maintain bacterial populations to assist with water treatment. The three basins have a combined surface area of 56 acres, an average depth of 12 feet, and a total capacity of approximately 670 acre-feet.

The north (Pond 15) and south polishing ponds were used for further settling of biological solids after aeration of the wastewater (Photo 4). Water from the north polishing pond could be diverted, if needed, to the Color Removal Plant for further reduction in color. As the bleaching process contributed a proportionally large amount of color to the wastewater, this diversion primarily occurred prior to 1999 when the bleach plant was closed (Smurfit-Stone 2004). The two polishing ponds have a combined surface area of 43 acres, an average depth of 7.6 feet, and a total capacity of 328 acre-feet.

After polishing, treated waste water was diverted to twelve storage ponds prior to discharge from three permitted outfalls to the Clark Fork River (Ponds 1, 1A, 2, 7, 9, 10, 11, 12, 13, 13A, 16, 18) (Photos 1, 6, 12, 13, 15, 28). The twelve ponds have a combined surface area of 707 acres, an average depth of approximately 8 feet, and a total capacity of 5,772 acre-feet. At the time of the site reconnaissance, some of the ponds were revegetated (assumed via planting), while others were filled with wastewater.

It is assumed that possible contaminants in the basins and polishing and storage ponds are similar to those in the sludge ponds (e.g., PCBs, dioxins, furans), but would be expected to be at lower concentrations if present. Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal (MDHES 1974, Smurfit-Stone 2004).

4.1.4 Landfills and Other Dumping Locations

The mill landfilled all facility-generated solid waste onsite from the inception of the mill (1957) until 1993. The majority of landfilling occurred in an area immediately adjacent to and west of the core industrial area of the mill (Figure 2). Disposal primarily occurred in three areas (Stone Container 1992):

- Pond (Landfill) A: General refuse (including, but not limited to paper, plastic, scrap metal, wood, glass, and small amounts of food);
- Pond 6: hog fuel ash, lime kiln grits, and;
- The adjacent areas 'C' (hog fuel ash, lime kiln grits, ragger wire) and 'F' (asbestos).

After being capped with 18 inches of clay and 6 inches of topsoil, formal closure of these three areas occurred in September 1995 (MDEQ 1995). There is no evidence in available documents that any landfilling area was lined.

It should be noted that photographs reportedly taken at Pond A in 1992 show unidentified drums amongst the waste (Thamke 1992).

Beginning in October 1993, all Class II waste generated by the mill (e.g., general refuse, ragger wire, multi-fuel boiler ash, used oil filters) was hauled offsite for disposal by BFI Inc. for disposal in BFI's Missoula landfill, while Class III material (e.g., sawdust, wood chips mixed with soil and gravel, log yard wood wastes, kiln bricks, small quantities of tires and other inert material) was landfilled in a newly permitted area (area 'G') adjacent to and north of Pond 16 (Stone Container 1995, Smurfit-Stone 1995). Double-bagged asbestos has also been disposed of in this location (Stone Container 1992).

The main facility general refuse landfill (Pond/Landfill A) has a surface area of 16 acres and an average depth of about 6 feet. Pond 6 has a surface area of 16 acres with an unknown average depth. Areas 'C' and 'F' have surface areas of approximately 8 acres and 3 acres, respectively. The Class III landfill begun in 1993 (area 'G') has a surface area of approximately 6 acres (Figure 2).

During the site reconnaissance, an area used to store disused equipment (i.e., the 'boneyard') was noted due west of the south polishing pond (Photo 29) (Figure 2).

It should be noted that cases of random dumping of material have also been alleged by former mill employees (Nielsen 2011).

4.1.5 Industrial Area (Recausticizing Area, Liquor Alley, Bleach Plant, Truck and Hog Fuel Loading Areas, Sewer Sumps)

The main industrial area of the mill covers approximately 100 acres (Photos 2, 8, 9, 17, 18, 33, 35, 36, 38, 39). The making of pulp and paper using the kraft process is complex (Photo 37) and uses (or produces) various hazardous chemicals including bleaching chemicals (liquid chlorine, sodium hypochlorite, and chlorine dioxide), liquid sulfur dioxide, liquid ammonia, sodium hydroxide, sodium salts, dimethyl disulfide, methylsulfide, liquors of high pH (white, green and black), turpentine, acids (sulfuric, muriatic, and phosphoric), and non-condensable gases. Various quantities of bulk petroleum products, including diesel fuel and #6 fuel oil, were also stored on site and used for power generation (Photo 36). Truck and train unloading facilities within the industrial area of the mill utilized large hydraulic equipment (Photo 9).

Although the kraft pulping process used at the mill depended heavily on the recovery and reuse of chemicals (particularly from the high pH liquors), the plant was designed such that 'sewer' lines from various areas of the facility would capture any leaks, spills, and overflows from transfer, handling, and storage systems, and direct them to the waste water treatment system (MDHES 1974, EPA 1993, Smurfit-Stone 2004).

The acid tanks were equipped with secondary containment, as were the # 6 fuel oil tank and all transformers (EPA 1993). Other equipment maintenance procedures reported to have been in place included the regular inspection and replacement of process lines (e.g., batch digester, chlorine, sulfur dioxide, acid transfer hoses). Spills of petroleum or chemicals of sufficient volume were directed to the mill's sewer system. Spills that reached the sewer system could be manually routed to the emergency spill pond (Pond 8) before reaching the wastewater treatment system (EPA 1993). In the case of petroleum spills, a Seacurtain booming system was available to contain the spill and allow it to be removed from the pond with a vacuum truck (EPA 1993).

The site reconnaissance conducted on June 22, 2011 did not include an inspection of the core industrial facility. In addition, detailed site plans of the facility were not available. As such, the identification of discrete point sources of potential contamination within the facility (e.g., sewer sumps) was not possible.

4.1.6 Landfarming Area

Landfarming of petroleum contaminated materials is reported to have occurred on a parcel of mill property located south of and adjacent to Lacasse Lane (Figure 2) (Photo 7). While no documentation of this activity was found, the practice was acknowledged by Neal Marxer, former Technical Services Manager at the mill during the site reconnaissance (Marxer 2011).

4.1.7 Above Ground and Underground Storage Tanks

The MDEQ Waste and Underground Tank Bureau has records of eight storage tanks (four above ground tanks [ASTs] and four underground tanks [USTS]) (Photo 36). Site assessment activities revealed evidence of leaks at three of the tanks. According to the MDEQ's Leaking Underground Storage Tank Query System, two tanks are listed as undergoing characterization and/or remediation. The tanks are summarized in the following table (MDEQ 2011b):

TABLE 2
Summary of Petroleum Storage Tanks at the Smurfit-Stone Mill Site

Tank (DEQ ID)	Contents	Capacity (gals)	Closure Status	Assessment Status
AST 1 (S5)	Bunker oil	1,000,000	Closed in place, 5/1996	Completed, leak detected
AST 2 (S6)	Bunker oil	300,000	Closed in place, 7/1996	Completed, no leak detected
AST 3 (S7)	Bunker oil	300,000	Closed in place, 7/1996	Completed, no leak detected
AST 4 (S8)	Not listed	21	Closed in place, 7/1996	Completed, leak detected
UST 1 (01)	Not listed	5,000	Closed in place, 7/1996	Completed, leak detected
UST 2 (02)	Not listed	5,000	Removed from ground, 6/1986	Not completed
UST 3 (03)	Not listed	10,000	Removed from ground, 6/1986	Not completed
UST 4 (04)	Not listed	5,000	Removed from ground, 7/1986	Completed, no leak detected

4.2 GROUNDWATER PATHWAY

The Smurfit-Stone Mill site is located adjacent to the Clark Fork River. The mill is underlain by a shallow alluvial sand and gravel aquifer. The alluvial aquifer is approximately 25 to 35 feet thick beneath the mill site and thins to the east. This alluvium is bounded on the west side of the Clark Fork River by Precambrian bedrock and by fine-grained Lake Missoula deposits immediately east of the mill site (Hydrometrics 2004).

The fine-grained Lake Missoula sediments extend underneath the shallow alluvial gravels, are approximately 120 to 150 feet thick, and have a reported vertical permeability of 3.5×10^{-5} cm/s (Grimestad 1992). These sediments are underlain by a thick coarse-grained alluvial aquifer which is the principal water supply aquifer for both the mill and for local ranches (Hydrometrics 2004). The estimated hydraulic conductivity of this deep alluvial aquifer is 5.3×10^{-1} cm/s (Grimestad 1992).

Depth to groundwater within the shallow alluvial (unconfined) aquifer varied across the site from 2.4 to 19.8 feet in July/August of 1991 (Grimestad 1992).

Groundwater flow directions in the shallow alluvial aquifer are generally to the west and north in the vicinity of the mill, towards the river. However, flow directions vary seasonally in response to areal recharge, water level fluctuations in the mill's wastewater storage ponds, seasonal changes in the stage of the Clark Fork River, and seasonal flows in irrigation ditches (Hydrometrics 2004).

Groundwater velocity measured in background wells on the mill site average 4 feet per day and hydraulic conductivity measured across the entire mill site averages approximately 335 feet per day (Grimestad 1992).

Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal (MDHES 1974, Smurfit-Stone 2004). As such, the shallow alluvial aquifer has been contaminated with mill effluent. As reported by the MDHES in the Environmental Impact Statement for the proposed expansion of the mill:

> *The shallow aquifer underlying the effluent storage ponds contains considerable seepage water from the pond system. Pond wastes have also entered the deep aquifer in the vicinity of the plant. The quality of percolated wastewaters is significantly inferior to natural groundwater.* (MDHES 1974, page 180).

In addition, Grimestad has stated:

> *....ongoing Mill chemical sampling indicates that the underlying groundwaters are already carrying a significant load of the expected leachate constituent chemicals from nearby storage pond and effluent-distribution ditch leakage.* (Grimestad 1992, page 11).

Although both Grimestad and Hydrometrics reported that groundwater flow occurs from the deeper aquifer, upwards to the shallow aquifer, MDHES reported in 1974 that, although there was a poor vertical hydraulic connection between the aquifers, pond wastes had already entered the deep aquifer due to leakage from the upper to the lower aquifer (MDHES 1974).

Whether releases to groundwater have occurred from other contamination sources (e.g., petroleum storage tanks, the industrial core area) is unknown. Groundwater analysis appears to have been limited to analytes related to general water quality (e.g., TDS, sodium) and nutrients, as per permit conditions (Smurfit-Stone 2004).

Numerous drinking water wells exist within 4 miles of the site (Table 3), including seven private domestic wells located along the northern boundary of the site and within the 'mixing zone boundary' for the site effluent (Hydrometrics 2004). All of the wells are completed in the deeper aquifer (total depths range from 141.5 to 169 feet below ground surface [bgs]).

Water quality samples collected from five of these seven residential wells showed no measured parameters above background levels and no evidence of influence from mill process water or constituents (Hydrometrics 2004).

All municipal water supply systems in the local area utilize groundwater (EPA 2011). The nearest municipal well is not currently known, nor is the number of people within 4 miles of the site who use groundwater domestically. A summary of commercial and private wells located within a 4-mile radius of the mill site is provided in Table 3 below:

TABLE 3
Wells within a 4-Mile Radius

Radius (in miles)	Number of Commercial and Private Wells
0 – 0.25	57
0.25 – 0.50	63
0.50 – 1.0	156
1.0 – 2.0	362
2.0 – 3.0	677
3.0 – 4.0	459
Total	**1,774**

Source: State of Montana, Department of Natural Resources and Conservation, Water Resources Division, 2011

4.3 SURFACE WATER PATHWAY

The western boundary of the site is the Clark Fork River, with the site having approximately 4 miles of river frontage (Photos 1, 6, 13, 14). Chloride-ion concentrations in mill site groundwater monitoring wells clearly show that mill effluent percolating through the wastewater storage ponds reaches the river (Grimestad 1992).

According to the 2008 Waterbody Report for the Clark Fork River, this stretch of the Clark Fork River (Fish Creek to Rattlesnake Creek) is impaired due to elevated levels of: arsenic, cadmium, copper, chlorophyll-A (algal growth), total nitrogen, total phosphorus, and organic enrichment (sewage). The metals are due to mill tailings that were historically deposited into the Clark Fork River drainage upstream (i.e., from Butte, Montana downstream to Milltown, just upstream from Missoula). The nutrients and organics are largely attributed to municipal and industrial point sources of pollution such as the mill and the Missoula wastewater treatment plant (EPA 2011c).

The MDEQ has conducted water quality sampling from a number of locations along the Clark Fork River adjacent and near the mill site. The vast majority of data are related to general water quality monitoring (e.g., pH, temperature, cations and anions) and nutrient loading to the river, although metals have also been analyzed at some locations (e.g., Station ID: 4214CL06).

As part of its National Bioaccumulation Study, the EPA collected fish tissue from both a largescale sucker and a rainbow trout at a location on the Clark Fork River near the Huson sampling station (approximately 6 miles downstream of the mill site). The tissue from the sucker showed detectable amounts of synthetic organic compounds including various chlorobiphenyls and 2,3,7,8 TCDF. The rainbow trout was only analyzed for dioxins and furans but also showed a detectable amount of 2,3,7,8 TCDF (EPA 1992).

Effluent sampling results from a water sample collected from a wastewater storage pond as reported in the 2010 MPDES permit application state that 2,3,7,8 TCDD was not detected at a reporting limit of 3.9 picograms per liter (pg/l) (MDEQ 2010a).

Surface water targets include sensitive environments downstream of the site. All municipal water supply systems in the local area appear to utilize only groundwater (EPA 2011).

The Clark Fork flows from the south to the north and has an annual mean discharge at a point below Missoula (USGS station 12353000, 4.5 miles west of Missoula) of 5,293 cubic feet per second (USGS 2011). Construction of the wastewater storage ponds on the mill site led to the relocation of the Clark Fork River channel to the west. Much of the mill site lies within the Federal Emergency Management Agency 100-year floodplain (FEMA 1988).

The mill site lies within the Clark Fork River valley and is generally flat, with an elevation range from approximately 3,070 feet near the mill facility to approximately 3,040 feet at the Clark Fork River in the northwest corner of the site. Overland flow from the site would generally travel west towards the river, although much of it would be captured in ponds or diverted by various ditches and channels, such as the non-contact cooling water ditch (Photo 10).

O'Keefe Creek flows from east to west across the southern extent of the mill property, adjacent to Ponds 17 (sludge), 1 A and 2 (both treated wastewater storage) (Figure 2). The USGS reported a stream flow measurement of 186.0 cubic feet per second from O'Keefe Creek in 1980 (USGS 2011). The creek had a substantial flow during the site reconnaissance (Photo 16).

Approximately half of the ponds contain palustrine freshwater emergent wetlands. The National Wetlands Inventory Database identifies over 2,600 acres of riverine and palustrine wetland within 4 miles of the site, and riverine wetlands are continuous downstream of the mill for the entire extent of the 15-mile downstream target distance limit (TDL) (Appendix F) (USFWS 2011a). However, only a fraction of these are Hazard Ranking System eligible.

Within the TDL, there are approximately 135 acres of palustrine freshwater forested/shrub wetlands, and 8 acres of freshwater emergent wetland directly adjacent to the Clark Fork River, equating to over 8 miles of wetlands frontage.

The entire length of the 15-mile TDL is considered a fishery with a Montana Fish, Wildlife and Parks (MFWP) fishery resource value of 1 (Outstanding). The MFWP Deep Creek fishing access site is located at the confluence of Deep Creek and the Clark Fork, approximately 0.5 mile upstream of the southern mill site boundary. The 423-acre MFWP Erskine fishing access site begins approximately 2.5 miles downstream of the mill site and stretches for approximately 2.5 river miles (MFWP 2011). There were an estimated 37,996 angling days per year on this segment of the Clark Fork River in 2009. Recreational fishing for the following species is reported in the fishery: brown trout, largemouth bass, mountain white fish, smallmouth bass, rainbow trout, northern pike, yellow perch, and westslope cutthroat trout (MFWP 2011). It is assumed that fish are caught for consumption, but evidence of this has not been gathered.

An estimate of the quantity of fish in the segment of the river adjacent to the mill could not be found. However, a 1990 fish survey along the Erskine fishing access site showed 17 brown trout for every 1,000 feet of river length (MFWP 2011). A 2007 study within the Deep Creek fishing access site found no mussels were present.

Numerous river rafting companies offer float trips on the Clark Fork River, although it is not clear if any float the segment of the river adjacent to the mill site.

The river segment adjacent to the mill is listed as a Wildlife Protected Area as it is a bald eagle nesting area, a big game critical wintering area, and is a historic peregrine falcon nesting area (MFWP 2011).

Threatened and endangered species present within Missoula County are shown in Table 4 below (USFWS 2011b):

TABLE 4
Endangered and Threatened Species in Missoula County

Species Scientific Name	Common Name	Status
Haliaeetus leucocephalus	Bald Eagle	*
Ursus arctos horribilis	Grizzly Bear	Federally-listed Threatened
Howellia aquatilis	Water Howellia	Federally-listed Threatened
Lynx canadensis	Canadian Lynx	Federally-listed Threatened
Salvelinus confluentus	Bull trout	Federally-listed Threatened

*Though not currently listed as threatened or endangered by the USFWS under the Endangered Species Act, the bald eagle is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

The Clark Fork River has been identified as nodal habitat for the federally listed endangered bull trout. Nodal habitats are defined as waters that provide migratory corridors, over wintering areas, or are otherwise critical to the population at some point in its life history. Nodal waters are essential for the survival of migratory bull trout.

The Montana Natural Heritage Program (MNHP) lists 65 animal species of special concern, including 9 mammals and 23 birds, as well as 49 plant species of special concern as occurring in Missoula County (MNHP 2011).

4.4 SOIL EXPOSURE PATHWAY

Soil exposure targets could include a limited number of workers who are conducting salvage operations (e.g., removing equipment) from the industrial core of the mill. The number of current workers onsite is unknown, but during the site reconnaissance it appeared to be fewer than 20.

At the time of the site reconnaissance on June 22, 2011, all four sludge ponds as well as the emergency spill pond were completely, or nearly dry (Photos 2, 3, 15, 17, 18, 19, 24, 25, 27, 30, 31). Pond 3 had recently been covered with 10 to 12 inches of wood chips, reportedly for dust control (Marxer 2011) (Photo 18). It is feasible that fugitive dust emissions could occur from the surface of uncovered ponds.

After being capped with 18 inches of clay and 6 inches of topsoil, formal closure of the three former landfill areas occurred in September 1995 (MDEQ 1995). These areas are currently largely revegetated (Photo 20).

The nearest residences are located in a small development approximately ½ mile east and southeast of the core industrial area (and within ¼ mile of the mill property boundary). In addition, a ranch that lies within the boundary of the site, is located approximately 1 mile due north of the industrial area of the mill site. Access to the core industrial area of the site is controlled, and there were security guards present at the facility entrance during the site reconnaissance. The entire 3,200-acre site was not fenced, however, and access could be gained from the Clark Fork River. Nevertheless, no evidence of public use was noted during the site reconnaissance.

Population within 4 miles of the site is shown in Table 5 below:

TABLE 5
Population within 4 Miles of the Smurfit-Stone Mill Site

Distance from Site	Population (# of persons)
On Site	0
0 – ¼ Mile	241
>¼ – ½ Mile	218
>½ – 1 Mile	85
>1 – 2 Miles	838
>2 – 3 Miles	1,836
>3 – 4 Miles	1,030
Total within 4 Miles	**4,248**

Source: U.S. Census Bureau 2000

Threatened and endangered species are described in the Surface Water Pathway section above.

4.5 AIR PATHWAY

The mill site is located in a semiarid climate zone. Prevailing wind direction is from the northwest. It is feasible that particulate contaminants (e.g., from the surface of the dry, uncovered sludge ponds) could be blown off site.

Total wetlands acreage within 4 miles of the mill site boundary is shown in Table 4 below:

TABLE 6
Wetlands within 4 Miles of the Smurfit-Stone Mill Site

Distance from Site	Wetlands (acres)
On Site	986
0 – ¼ Mile	261
>¼ – ½ Mile	84
>½ – 1 Mile	260
>1 – 2 Miles	420
>2 – 3 Miles	430
>3 – 4 Miles	227
Total within 4 Miles	**2,668**

Source: USFWS 1975, National Wetlands Inventory.

Access to the core industrial area of the site is controlled and there were security guards present at the facility entrance during the site reconnaissance. The entire 3,200 acre site was not fenced, however, and access could be gained from the Clark Fork River. The nearest residences are located in a small development approximately ½ mile east and southeast of the core industrial area (and within ¼ mile of the mill property boundary).

5.0 SUMMARY

The site began operation as a pulp mill in the fall of 1957. Later expansions and improvements allowed the facility to produce paper, primarily rolls of kraft linerboard, which is used in the production of corrugated containers (i.e., the outside layers of cardboard boxes). From 1960 through 1999 the mill bleached a portion of its pulp and paper. The mill shut down operations in January 2010.

Potential sources of contamination at the site include: sludge ponds, aeration basins and treated water ponds, an emergency spill pond, landfills and other dumping locations, various process areas within the industrial footprint, a former landfarming area, and ASTs and USTs. Contaminants of concern at similar pulp and paper mills across the country have included PCBs, petroleum hydrocarbons, PAHs, arsenic and other metals. In addition, the use of chlorine for the bleaching of pulp produces chlorinated organic compounds, including dioxins, furans, phenols, guaiacols, catechols, chloroform, and numerous others through the reaction of chlorine with residual lignin (EPA 1990). Organic halides are also of concern at kraft pulp mills where bleaching has been performed (EPA 1993).

The western boundary of the site is the Clark Fork River, with the site having approximately 4 miles of river frontage. Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal (MDHES 1974, Smurfit-Stone 2004). As such, the shallow alluvial aquifer has been contaminated with mill effluent.

Chloride-ion concentrations in mill site groundwater monitoring wells clearly show that mill effluent percolating through the wastewater storage ponds reaches the river (Grimestad 1992).

At the time of the site reconnaissance on June 22, 2011, all four sludge ponds as well as the emergency spill pond were completely or nearly dry. Pond 3 had recently been covered with 10 to 12 inches of wood chips, reportedly for dust control (Marxer 2011). It is feasible that fugitive dust emissions could occur from the surface of uncovered ponds.

All municipal water supply systems in the local area appear to utilize only groundwater (EPA 2011). Over 4,200 people live within 4 miles of the site.

Within the TDL, there are approximately 135 acres of palustrine freshwater forested/ shrub wetlands, and 8 acres of freshwater emergent wetland directly adjacent to the Clark Fork River, equating to over 8 miles of wetlands frontage.

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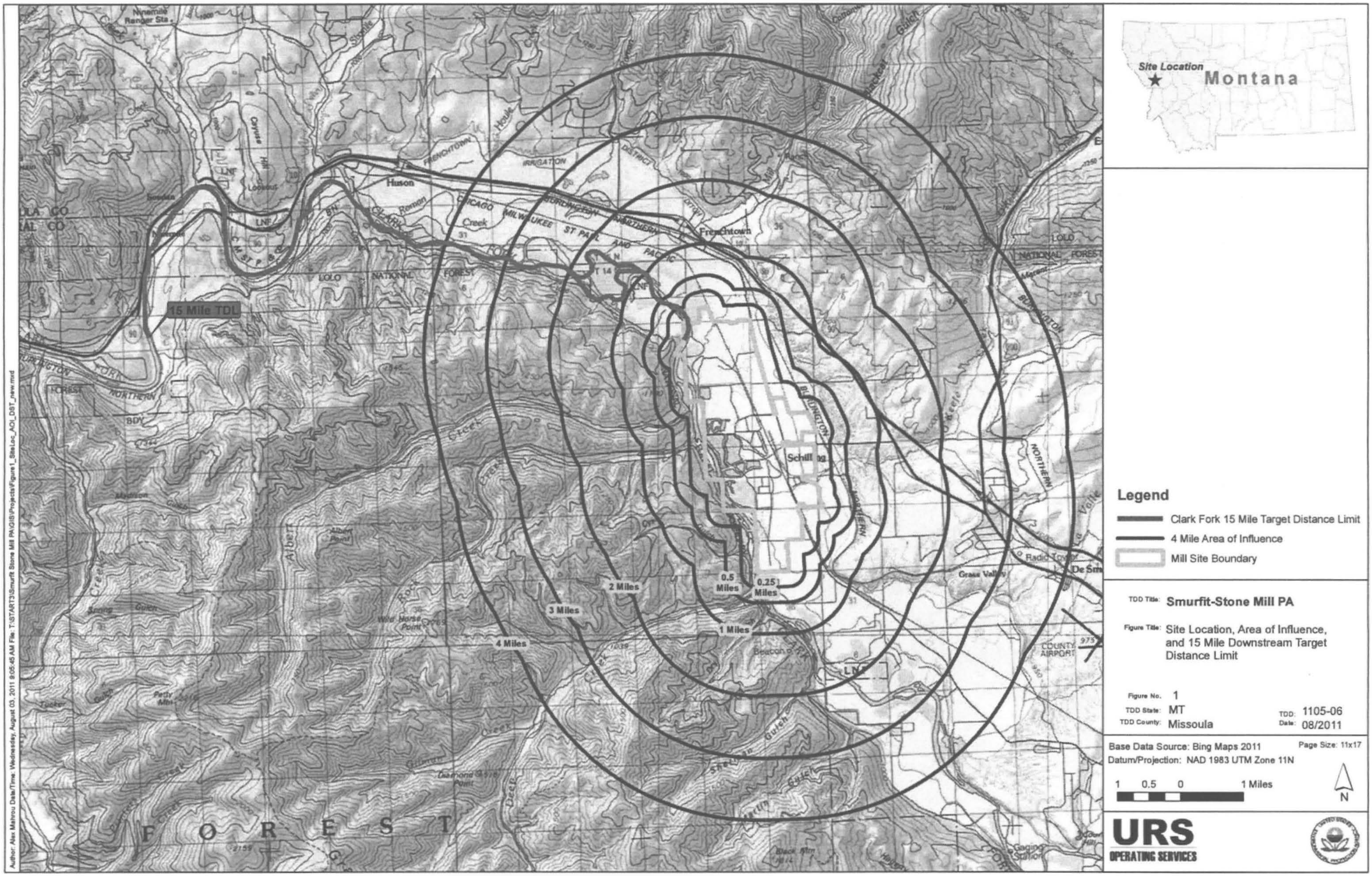
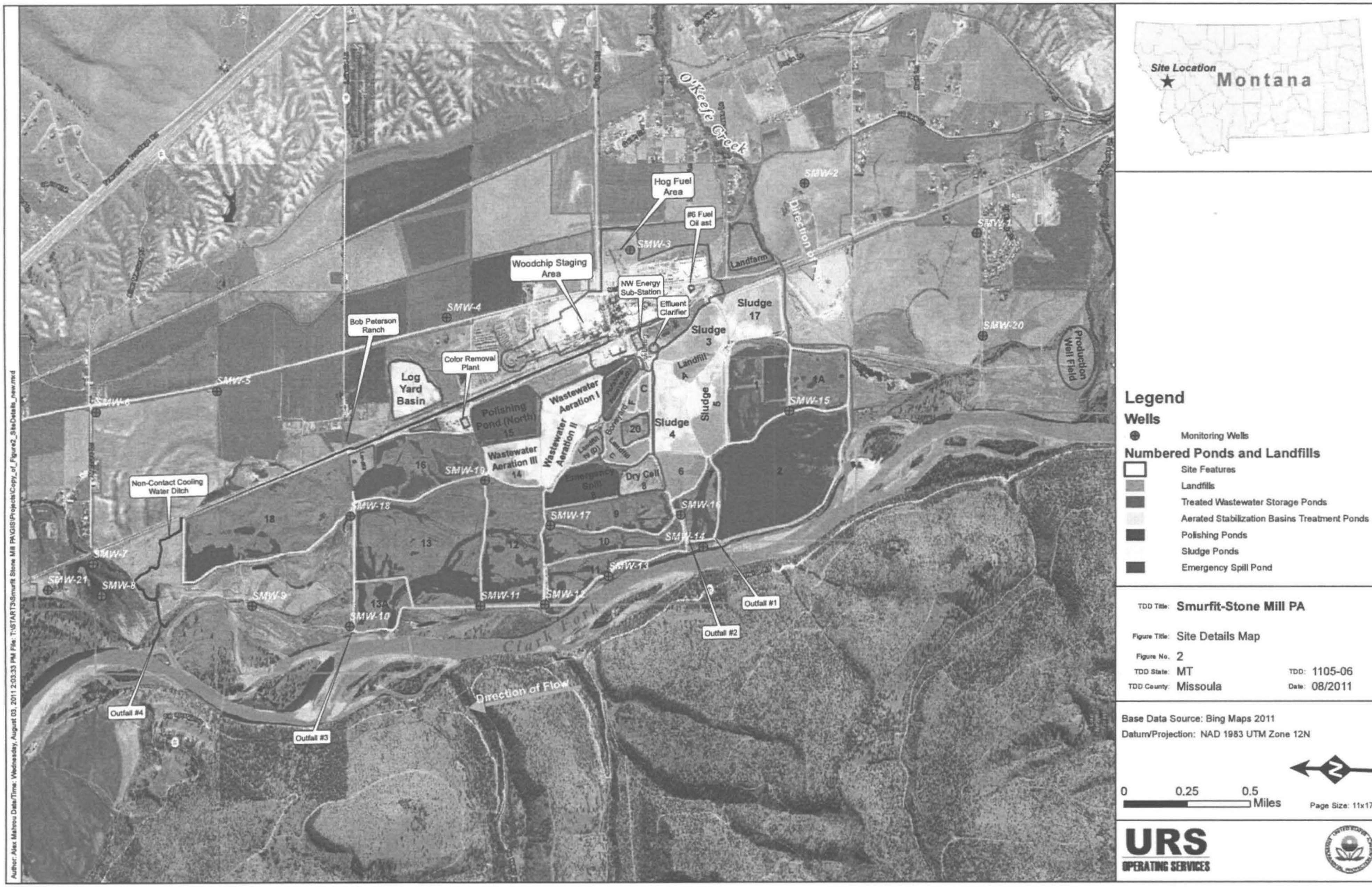


Site Location
Montana
Legend
Clark Fork 15 Mile Target Distance Limit
4 Mile Area of Influence
Mill Site Boundary
TDD Title: Smurfit-Stone Mill PA
Figure Title: Site Location, Area of Influence, and 15 Mile Downstream Target Distance Limit
Figure No. 1
TDD State: MT
TDD County: Missoula
TDD: 1105-06
Date: 08/2011
Base Data Source: Bing Maps 2011
Page Size: 11x17
Datum/Projection: NAD 1983 UTM Zone 11N
1 0.5 0 1 Miles
N
URS
OPERATING SERVICES
15 Mile TDL
0.25 Miles
0.5 Miles
1 Miles
2 Miles
3 Miles
4 Miles
Huson
Frenchtown
Schilling
LOLO NATIONAL FOREST
F O R E S T



Site Location
Montana
O'Keefe Creek
Hog Fuel Area
#6 Fuel Oil ast
Woodchip Staging Area
NW Energy Sub-Station
Effluent Clarifier
Landfarm
Sludge 17
Sludge 3
Landfill A
Sludge 5
Sludge 4
Bob Peterson Ranch
Color Removal Plant
Log Yard Basin
Polishing Pond (North) 15
Wastewater Aeration I
Wastewater Aeration II
Wastewater Aeration III 14
Emergency Spill 8
Dry Cell 8
Non-Contact Cooling Water Ditch
Production Well Field
Direction of Flow
Clark Fork
Outfall #1
Outfall #2
Outfall #3
Outfall #4
SMW-1
SMW-2
SMW-3
SMW-4
SMW-5
SMW-6
SMW-7
SMW-8
SMW-9
SMW-10
SMW-11
SMW-12
SMW-13
SMW-14
SMW-15
SMW-16
SMW-17
SMW-18
SMW-19
SMW-20
SMW-21
Legend
Wells
Monitoring Wells
Numbered Ponds and Landfills
Site Features
Landfills
Treated Wastewater Storage Ponds
Aerated Stabilization Basins Treatment Ponds
Polishing Ponds
Sludge Ponds
Emergency Spill Pond
TDD Title: Smurfit-Stone Mill PA
Figure Title: Site Details Map
Figure No. 2
TDD State: MT
TDD: 1105-06
TDD County: Missoula
Date: 08/2011
Base Data Source: Bing Maps 2011
Datum/Projection: NAD 1983 UTM Zone 12N
0 0.25 0.5 Miles
Page Size: 11x17
URS
OPERATING SERVICES
Author: Alex Mahrou Date/Time: Wednesday, August 03, 2011 2:03:33 PM File: T:\START3\Smurfit Stone Mill PA\GIS\Projects\Copy_of_Figure2_SiteDetails_new.mxd